Update on residuals studies

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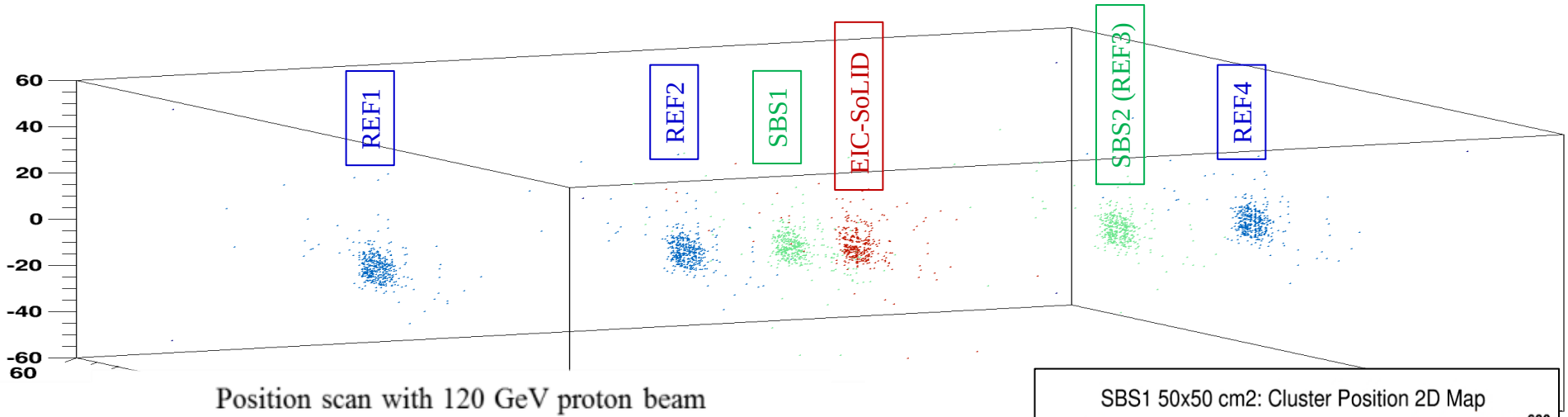
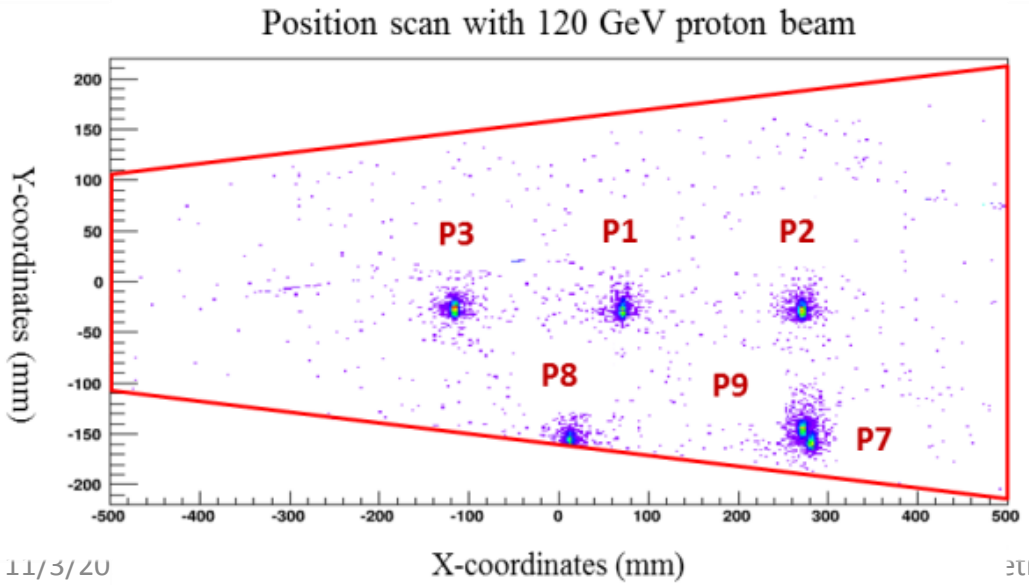
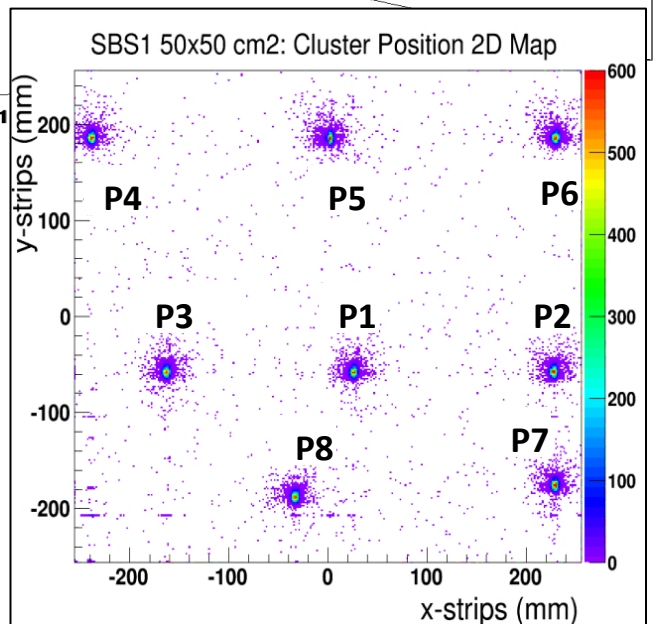
EIC Weekly meeting, Nov 3, 2014

Tuning the resolution analysis of FTBF 120 GeV Proton run:

- Rotation angle correction to the alignment for the fit, to compensate the tilt of the chambers in XY plane along the beam direction z. Initial correction parameters provided by Alexander
- Z position does not affect too the results because the proton beam is almost normal to the detector plane

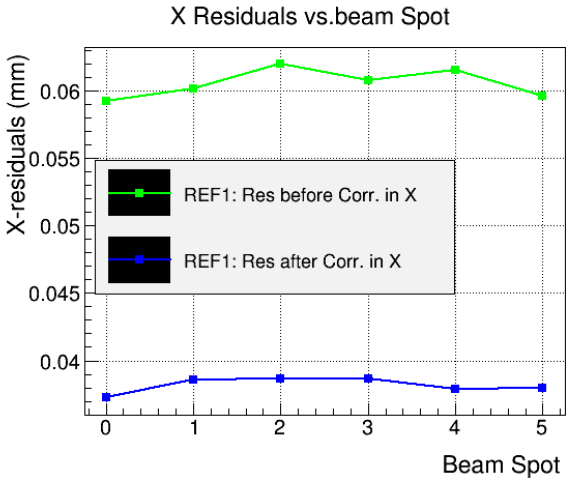


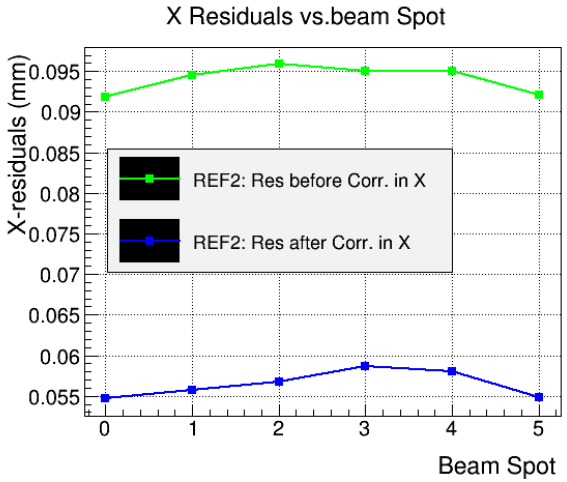


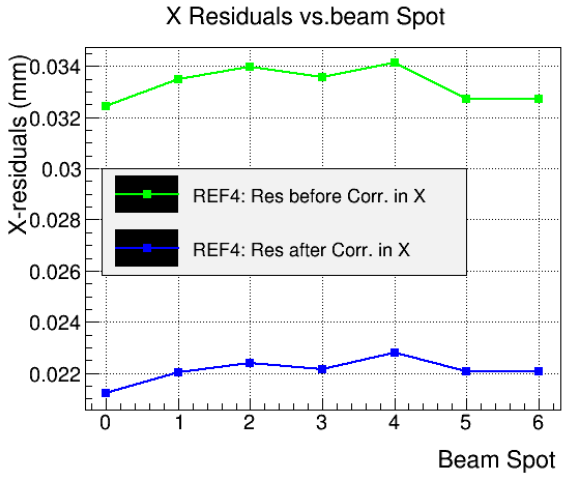


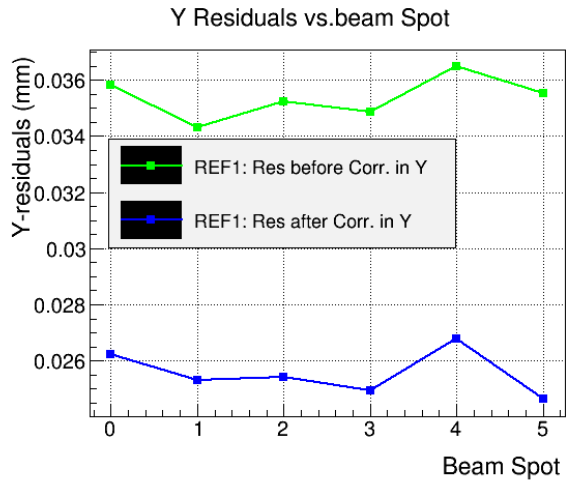
Trackers residuals: before and after XY plane rotation correction

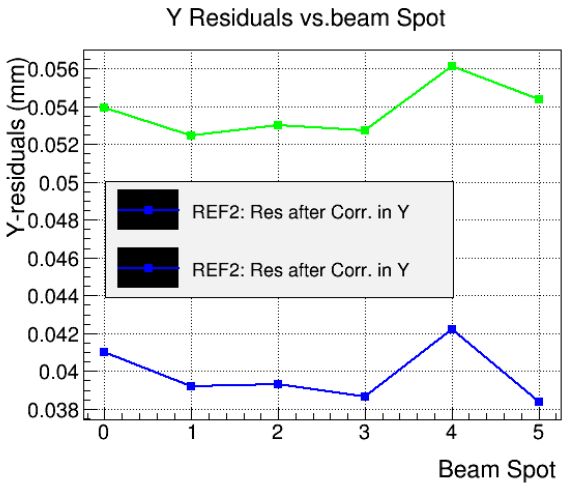
- Shows big improvement seen on the trackers residuals notably the REF2 as well as REF3 (SBS2)

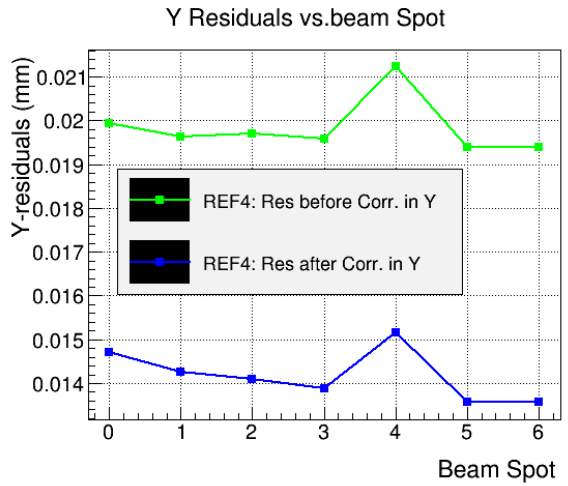




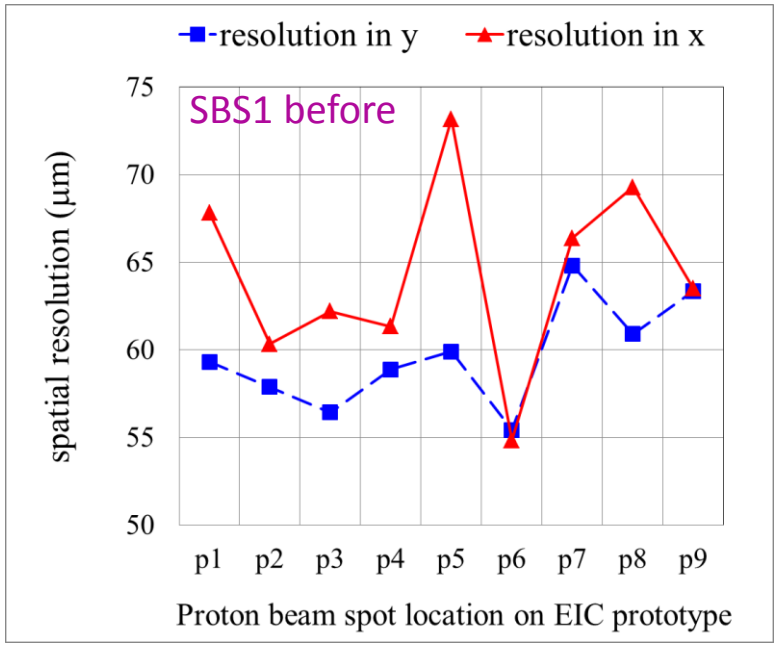


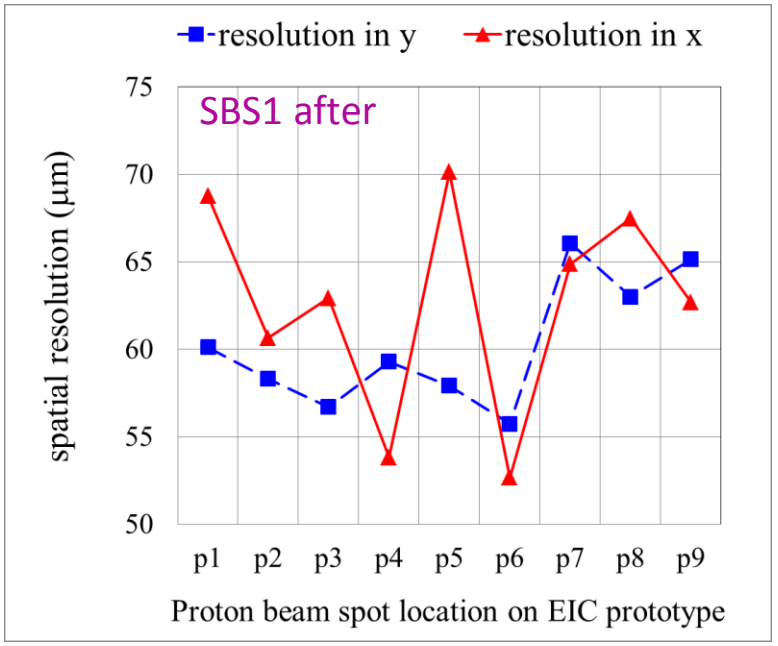


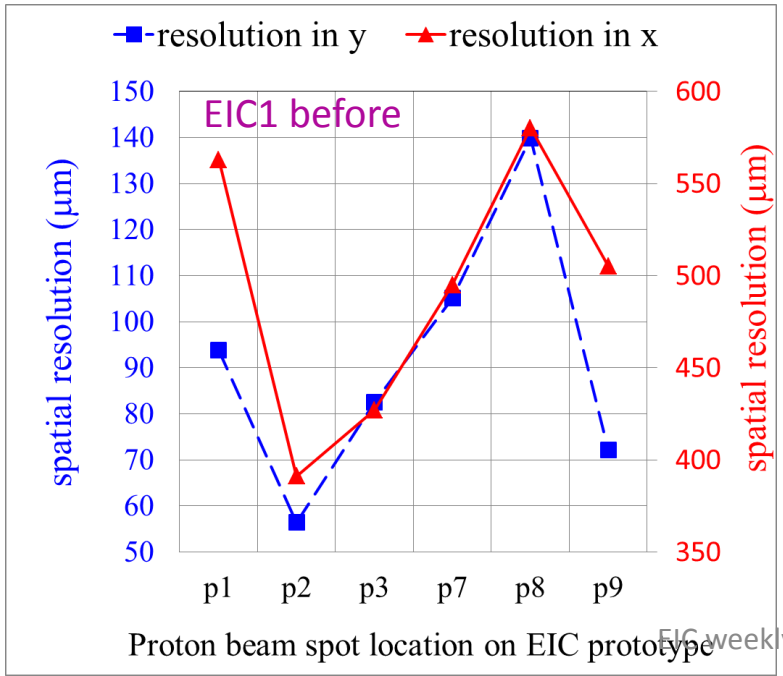


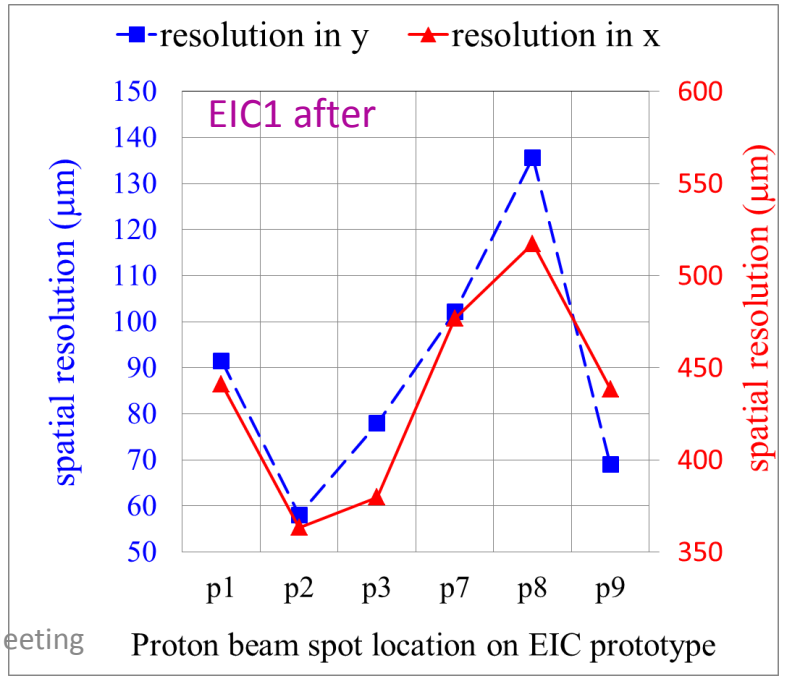


SBS1 & EIC Residuals: before and after rotation correction



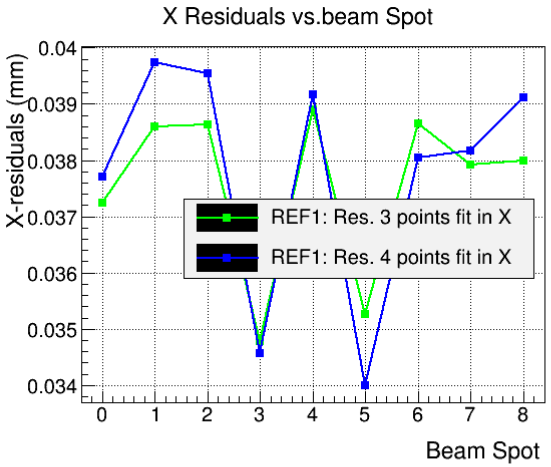


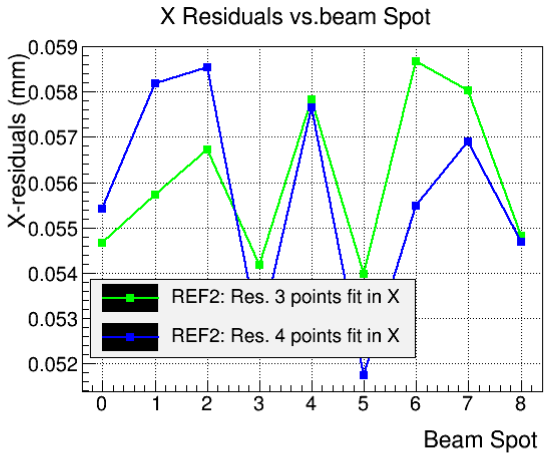


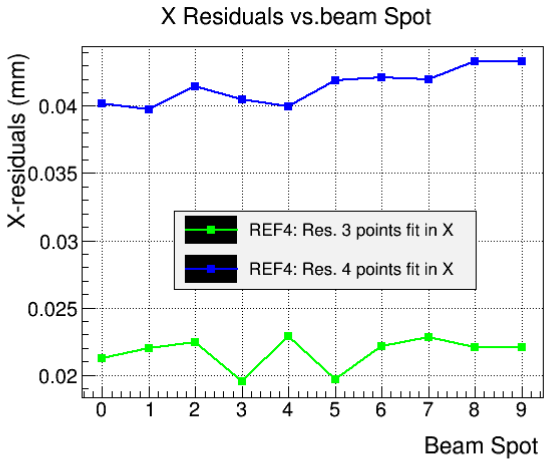


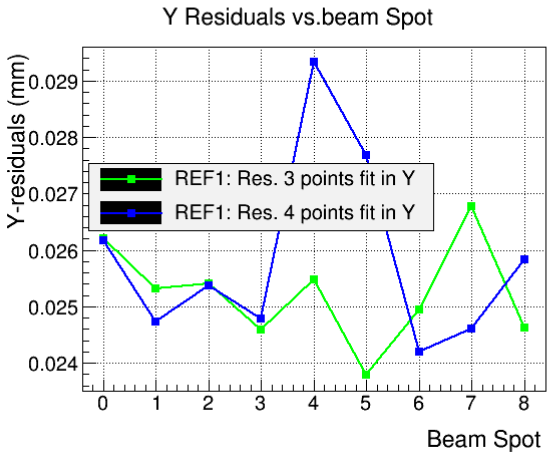
Track fit performance: Inclusive residual on small trackers

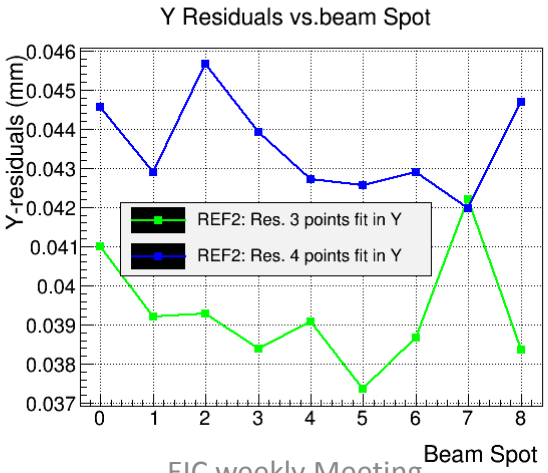
- 3-points fit: only 3 small trackers REF1, REF2, REF4; 4-points fit: 3 small trackers + SBS2 (REF3)
- No significant differences between 3-point and 4-points fits for REF1 and REF2 (2 trackers upstream)
- Big increase of the inclusive residuals for REF4 when SBS2 REF3 is used for the fit
- Conclusion: 4-points fit is a closer to the real track of the particles

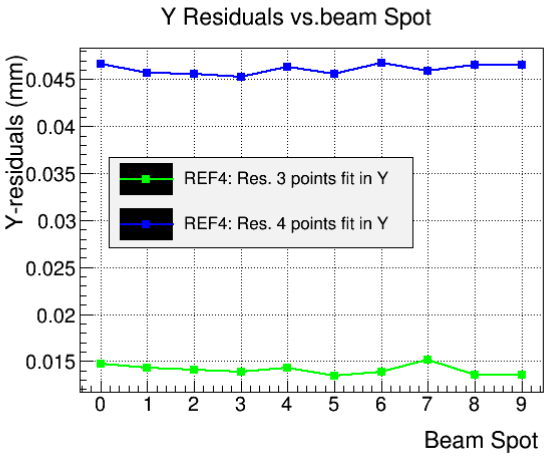








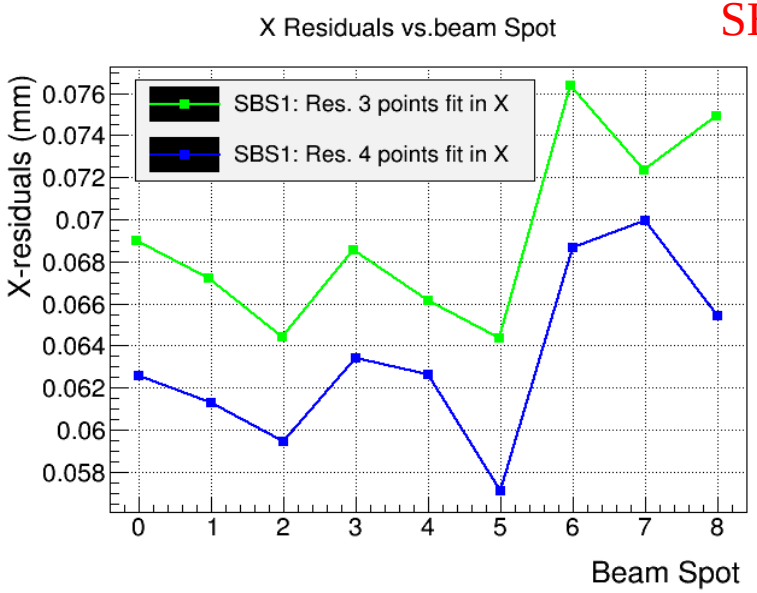


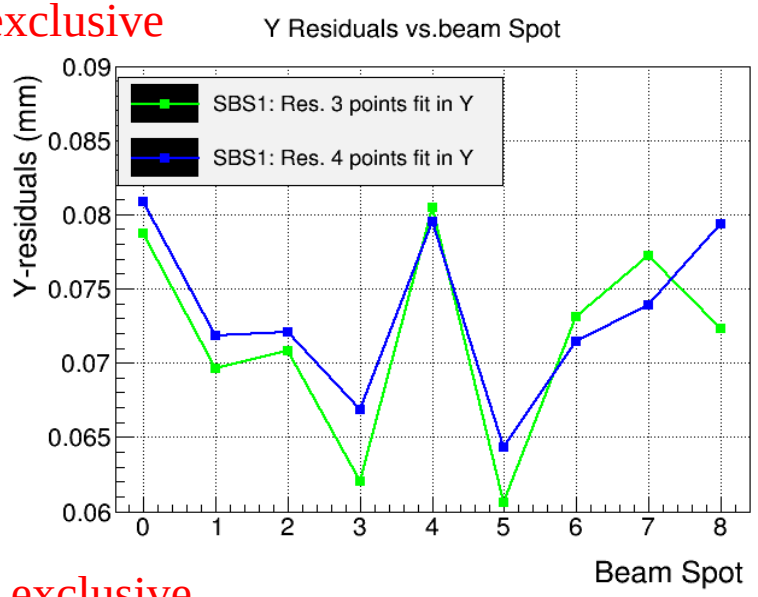


Track fit performance: Exclusive residual EIC and SBS1

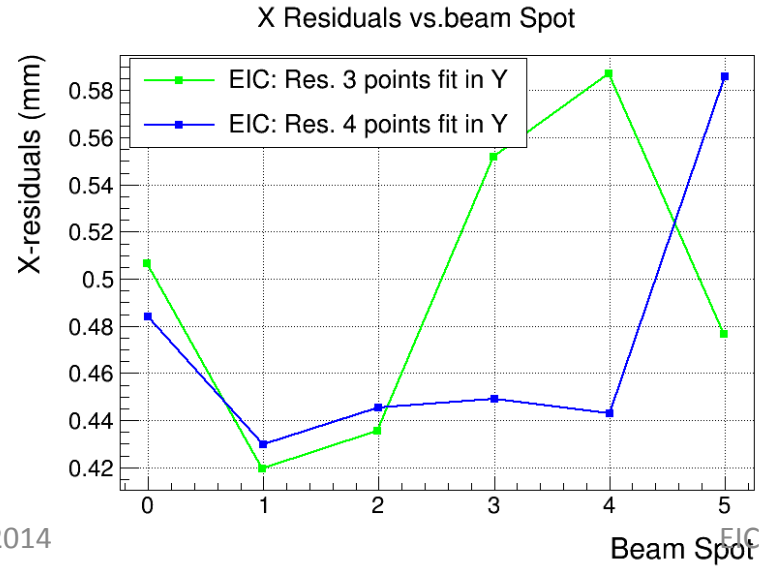
- Small improvement on the residuals from 3-points fit to 4-points fits but some fine are still needed for the 4-points fits

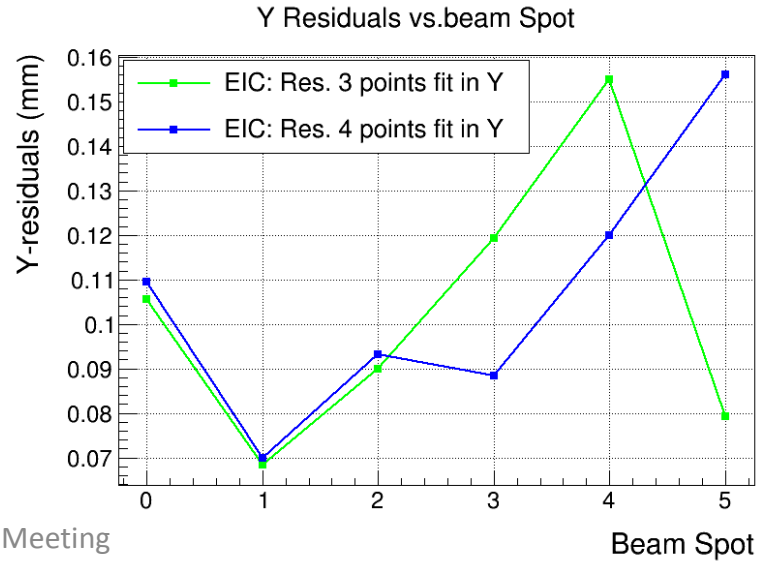
SBS1 exclusive





EIC1 exclusive

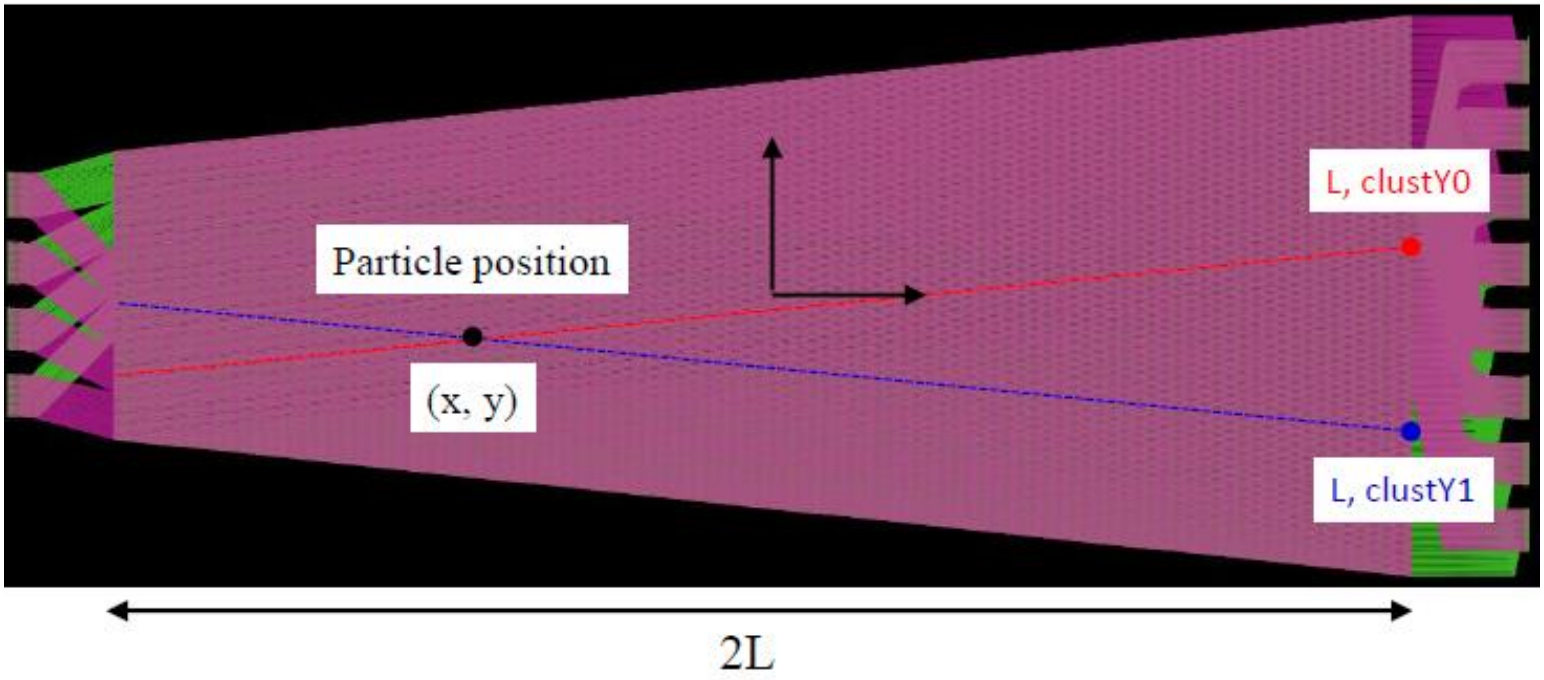




EIC Proto: direct method for 2D coordinates (x,y)

The (x,y) coordinates of the particle are obtained from the intersection point of the two straight lines defined by the measured cluster position on the large edge of the chamber (L, clustY1,0) and angle between the strips and the horizontal line

- $\theta = (6.067 \times \pi) / 180$
- $\alpha = \tan(\theta)$ and L = 500 mm
- $x = L + (clustY1 - clustY0) / (2 \times \alpha)$
- $y = (clustY1 + clustY0) / 2$

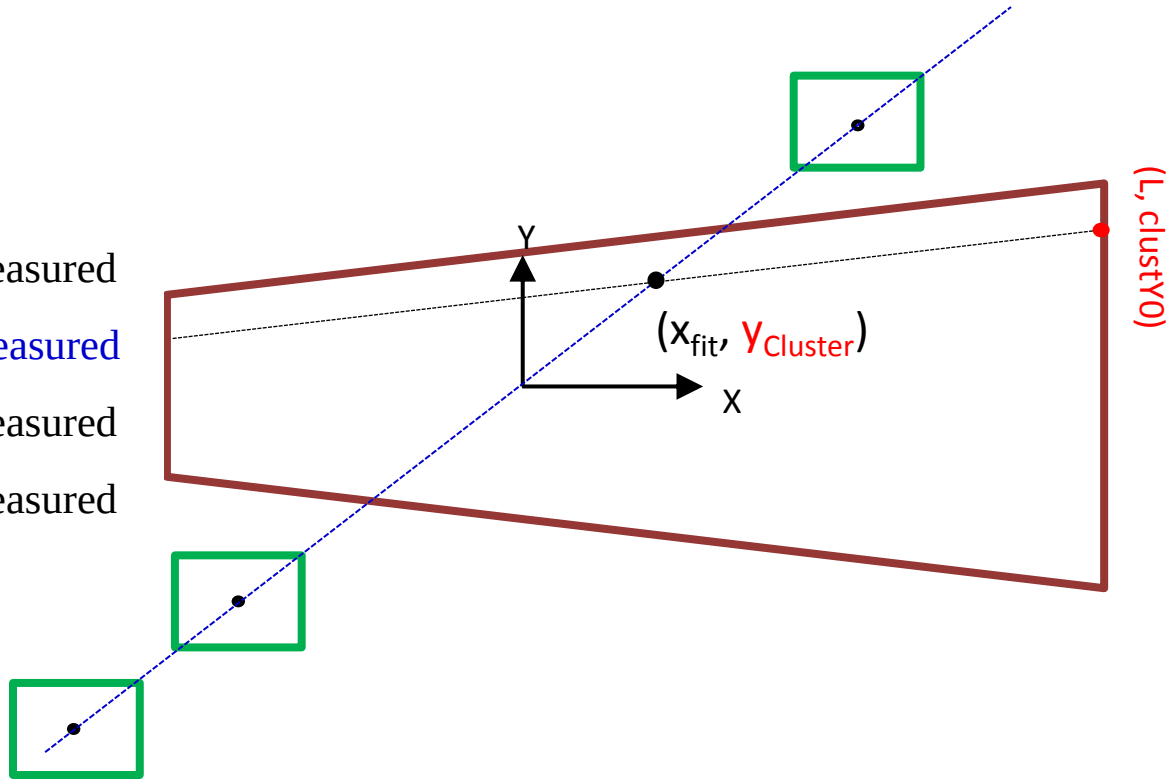


But this method does not allow a individual study and of the resolution of top and bottom strips

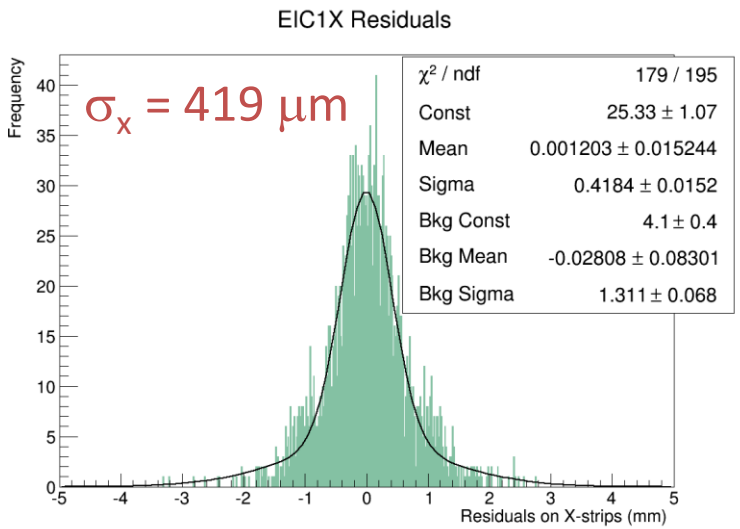
EIC Proto: y-coordinates from strips cluster and track fit

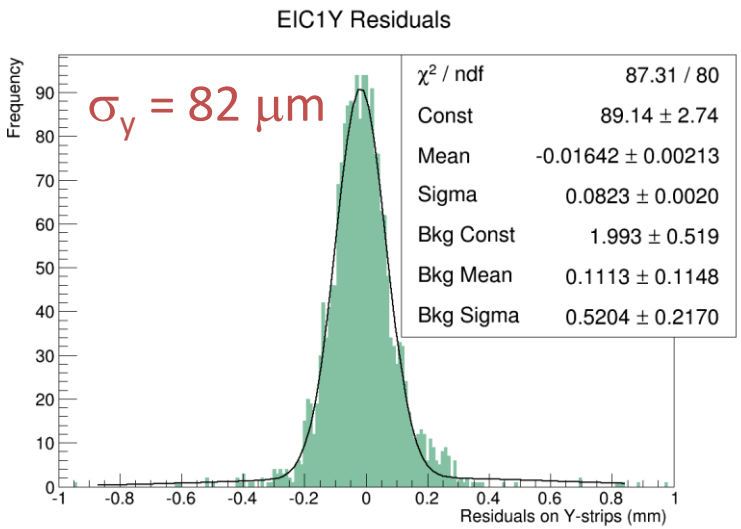
- To study the resolution given by the top/bottom strips, we need:
  - use the x_{fit} information is obtained from the track to obtain the $y_{cluster}$ from the straight line equation defined by the strip cluster clustY0 and the angle
- Doing so, we can get the residual for both top and bottom strips

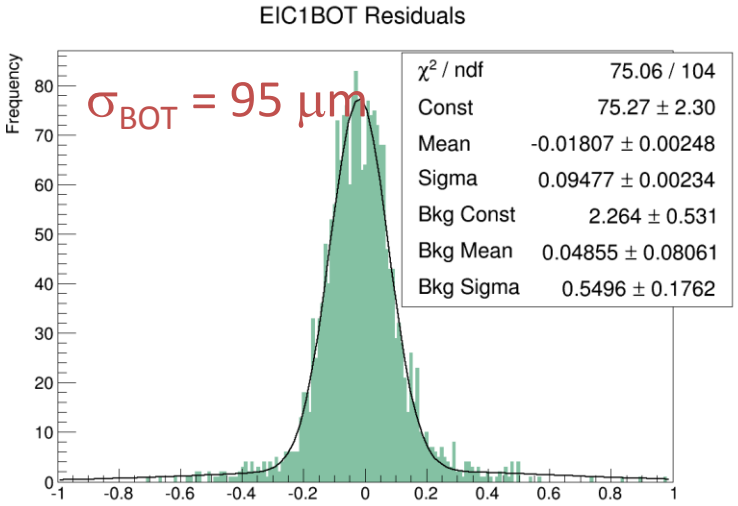
- $\sigma_x = \Sigma\ (x_{fit} - x$ measured
- $\sigma_y = \Sigma\ (y_{fit} - y)$ measured
- $\sigma_{top} = \Sigma\ (y_{fit} - yclust1)$ measured
- $\sigma_{bot} = \Sigma\ (y_{fit} - yclust2)$ measured

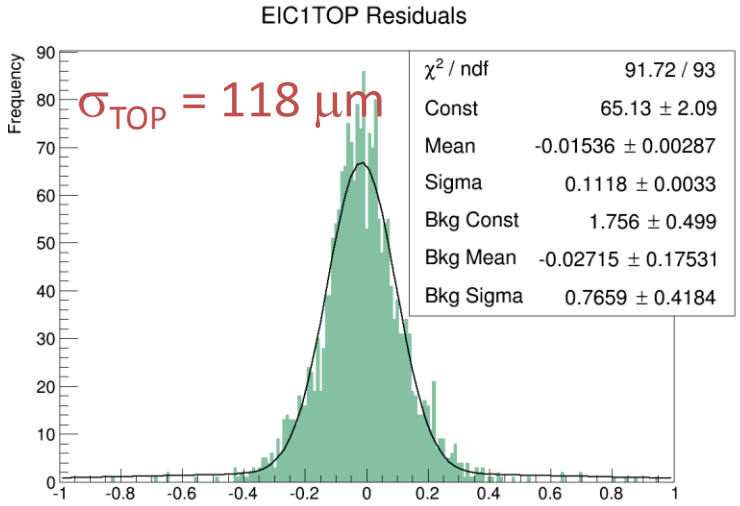


EIC Proto: exclusive residuals @ P9

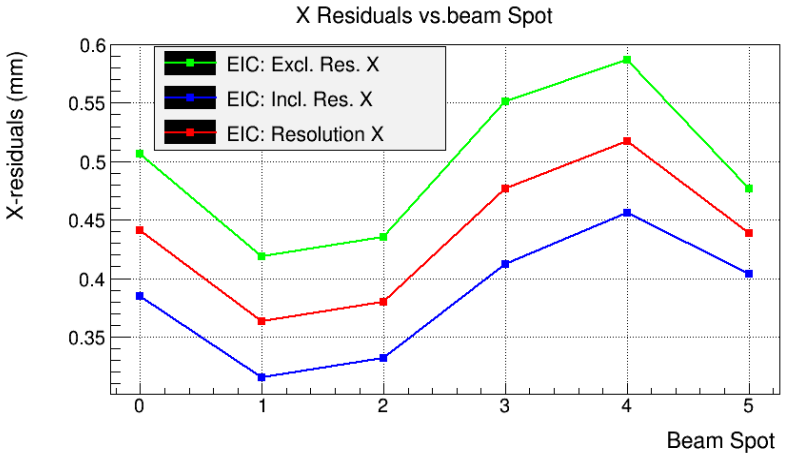


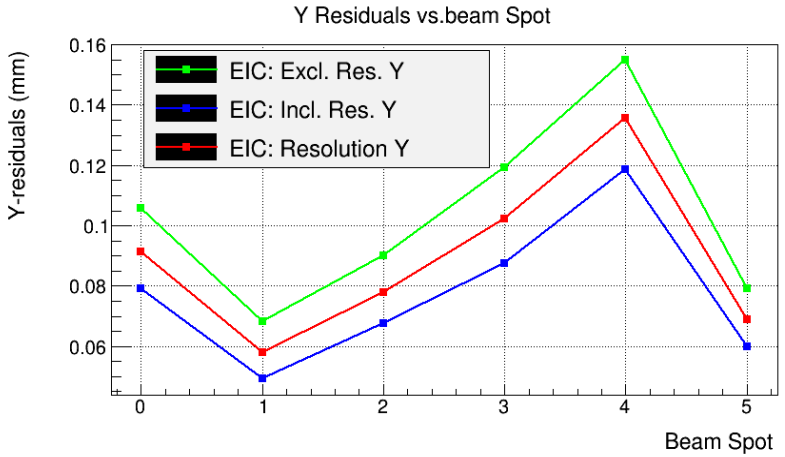


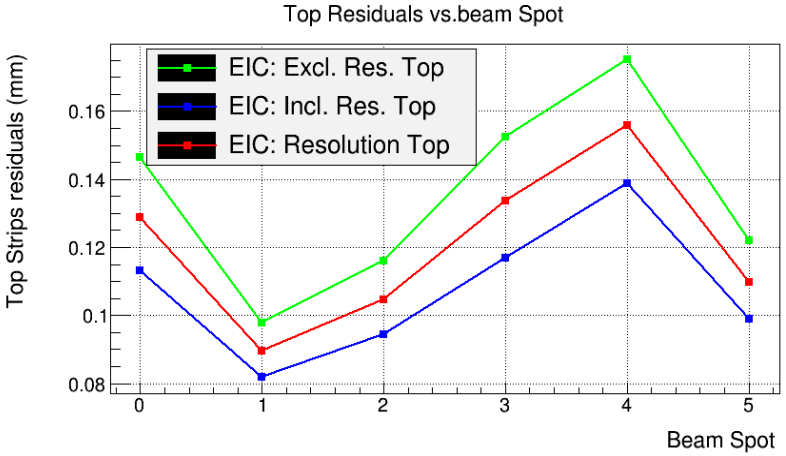


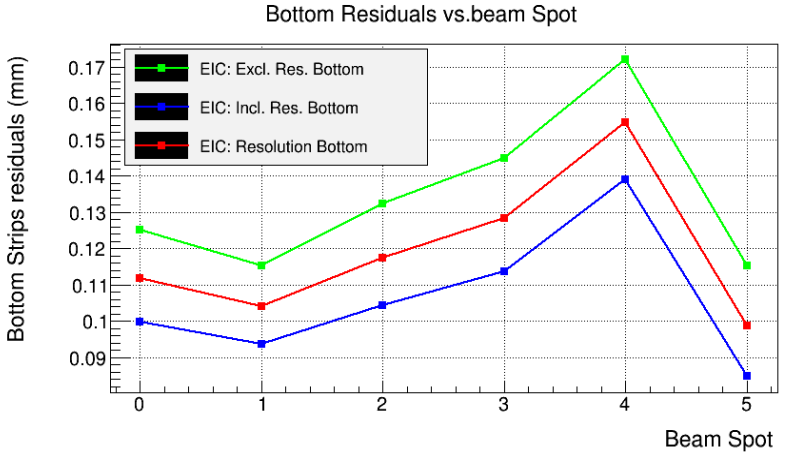


Resolution on EIC1 after rotation correction







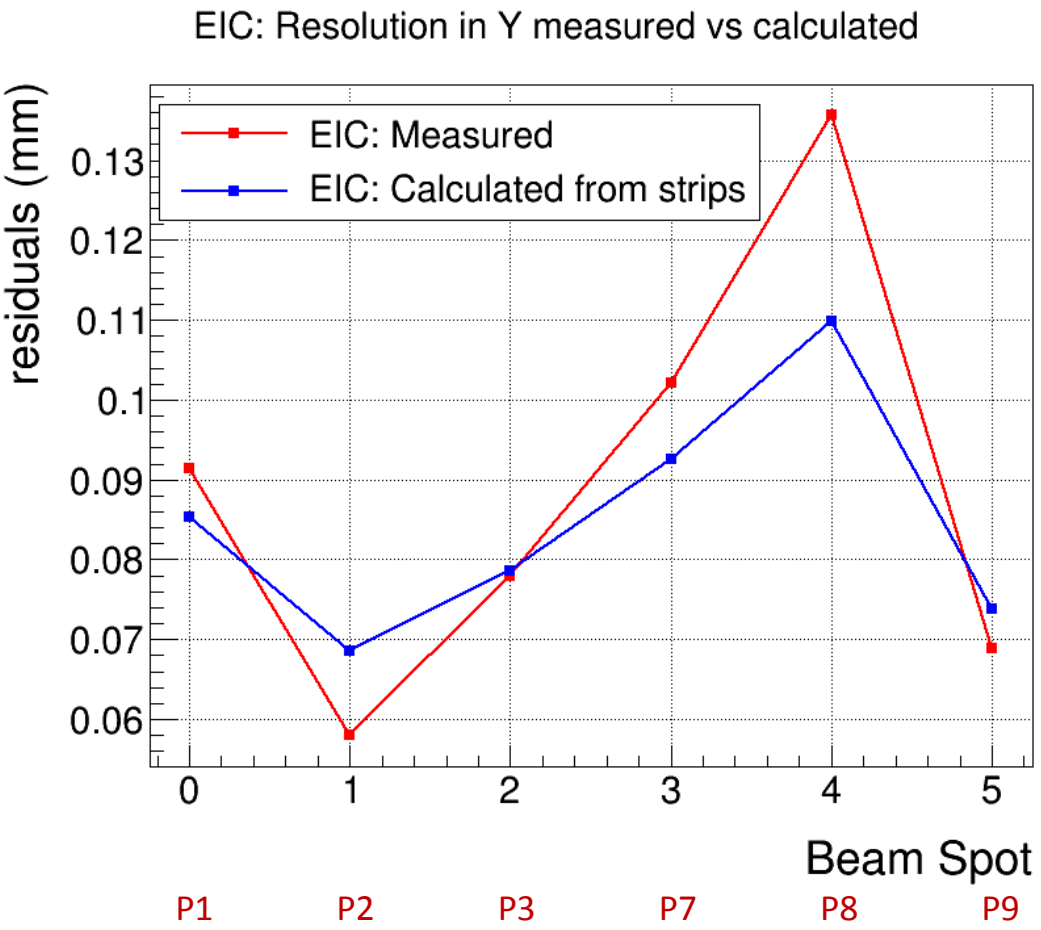


P1 P2 P3 P7 P8 P9

- Residuals for top and bottom strips => spatial non uniformity of the residuals
  - Can not be fully explained by the geometry of the strips
  - Probably an indication of gain spatial non uniformity to be investigated

EIC Proto: resolution on y direction from the two methods

- $\sigma_y = \Sigma\ (y_{fit} - y)$ measured
- $\sigma_{top} = \Sigma\ (y_{fit} - yclust1)$ measured
- $\sigma_{bot} = \Sigma\ (y_{fit} - yclust2)$ measured
- $\sigma_{ycal} = 0.5\ sqrt\ (\sigma^2_{top} + \sigma^2_{bot})$ calculated



- The difference between σ_y and σ_{ycal} is then explained by the error on the track fit
- This difference is less than10 μm everywhere except for point 4 where it is about 25 μm
- We can probably estimate the error using Alexander eicRoot and subtract it later from the data

Summary

- XY plane rotation correction added to the analysis for the residuals of the EIC and SBS chambers
- Big improvement on the trackers residuals
- This allow the use of 4th tracker (SBS2) for the track fit => improvement on the residual analysis for EIC and SBS chambers
- Study of the residuals of the top and bottom strips (1D information) of the EIC chamber.
  - Need to understand the spatial non uniformity of the residuals
- Good correlation between the resolution for y-coordinated extracted from the top and bottom strip analysis with the direct measurement of the y-coordinate resolution

To do list

- Just recently installed Alexander's EicRoot on my desktop
- The code has the FTBF setup implemented and should allow a comparative study
- Going to start to play with to learn it as user, will need support from Alexander
- Goal is to be able to extract some parameters from the simulated FTBF in order to improve the analysis of the test beam data